

National Aeronautics and Space Administration

Office of Space Science

SPACE SCIENCE ADVISORY COMMITTEE

**February 24-26, 1999
Radisson Conference Center
Cape Canaveral, Florida**

MEETING REPORT

Jeffrey D. Rosendhal
Executive Secretary

Steven W. Squyres
Chair

SPACE SCIENCE ADVISORY COMMITTEE

Cape Canaveral, FL

February 24-26, 1999

MEETING MINUTES

TABLE OF CONTENTS

Opening Remarks/Announcements	2
FY 2000 Strategic Plan Schedule and Status	2
Subcommittee Progress on Strategic Planning	3
Solar System Exploration	3
Sun-Earth Connection	4
Astronomical Search for Origins	5
Structure and Evolution of the Universe	5
Report from the Technology Task Force	6
Research Program Report	7
Space Operations Management Office (SOMO)	7
OSS Program and Budget Status	11
Theme Status Reports	13
Solar System Exploration	13
Sun-Earth Connection	13
Astronomical Search for Origins	14
Structure and Evolution of the Universe	14
Committee Discussions	15
Report from the Planetary Protection Task Force	16
Technology Program Highlights and Issues	17
Conclusion of Meeting	18
 Appendix A	 Agenda
Appendix B	Committee Membership
Appendix C	Meeting Attendees
Appendix D	Statements and Recommendations
Appendix E	List of Presentation Material

*Meeting Report Prepared By:
Paula Burnett Frankel, Consultant
RS Information Systems, Inc.*

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
Radisson Resort at the Port, Cape Canaveral, Florida
February 24-26, 1999

Wednesday, February 24

Opening Remarks/Announcements

Dr. Steven Squyres, Chair of the SScAC, welcomed members and meeting attendees. He noted that there had been a significant turnover in membership and expressed particular appreciation to the new members (Drs. Chyba, Kolb, Margon, Mewaldt, Richstone, and Smith) present at this meeting for their willingness to serve on the Committee. After introductions, Dr. Squyres reviewed the agenda and highlighted the three major critical topics for this meeting—the FY 2000 budget, the strategic planning process, and Space Operations and Management Office (SOMO) issues. He pointed out that, as an experiment, over the previous two days, all four of the Subcommittees had met concurrently. The experiment was a partial success. The concurrent meetings fostered the opportunity for cross-disciplinary discussions, but constraints on the agenda did not allow for as much interaction among all of the groups as was desired. In general, the bilateral meetings were productive, but having all four Subcommittees meeting simultaneously produced a situation which was too busy and too rushed. In the future, bilateral meetings will be encouraged as needed, but it is unlikely that all four Subcommittees will try to meet again.

FY 2000 Strategic Plan Schedule and Status

Dr. Marc Allen provided an overview of the planning process for the next version of the Space Science Enterprise Strategic Plan. The FY99 Performance Plan has been finalized, and the FY00 Performance Plan is on its way to Congress in conjunction with the submission of the budget. The first Performance Report (FY99) will be done this fall. The SScAC has the responsibility of assessing the Office of Space Science (OSS) progress against specific targets in that Plan. A process must still be developed for accomplishing this job. The schedule for the NASA Agency plan update is still under discussion. Dr. Allen discussed the various audiences to be served by the Space Science Enterprise Strategic Plan (the science community, NASA OSS, the Office of Management and Budget (OMB), Congress, the public, and NASA at the Agency level) and showed how the theme roadmaps and the Space Science Strategic Plan fit within the overall NASA Strategic Plan structure. A provisional plan outline has been circulated to the Chairs of the Subcommittee working groups to serve as the basis for the roadmapping activities. The next Strategic Plan will be very similar structurally to the 1997 plan. Part I will emphasize goals; Part II will focus on implementation. The Plan needs to be updated from the old plan in terms of near-term (2003-2007), mid-term (2008-2013), and far-term (25 years and beyond) timeframes. One of the main objectives of this Plan is to do a better job in incorporating technology, i.e., to interweave technology into the science program sections and focus on technical capabilities required for mid- and far-term missions. A summary of the technology program and phased capabilities will also be presented in one section. This version of the Plan will more clearly express the flow-down from the science mission to goals, objectives, and missions through use of tables in an appendix. Where possible, education and public outreach opportunities will be showcased in the program sections along with a summary section as before. Dr. Allen described

the schedule for the Strategic Plan: SScAC will be briefed on progress in July; roadmap activities must be completed by September 10, 1999, to prepare for the strategic planning workshop in November. A complete draft will be ready to be circulated for comment in January 2000 and discussed by the SScAC in February. In the April/May timeframe, NASA expects to hear from the Decennial Survey. This will allow a formal input from the Survey prior to final adjustments to the Plan. The SScAC will look at the final product in June 2000, with about 60 days for production, printing, and release by September 1, 2000. This schedule is the best compromise that could be achieved between the schedule for the update of the Agency Strategic Plan and the schedule for the Decennial Survey.

Subcommittee Progress on Strategic Planning

Solar System Exploration (SSE)

Dr. Chris Chyba, Chair of the Solar System Exploration Subcommittee (SSES), reported on SSES planning progress. The three theme-defining goals identified by the Subcommittee are: (1) chart our destiny in the solar system; (2) explain the formation and evolution of the solar system and the Earth within it; and (3) seek the origin of life and its existence beyond the Earth. Candidates for major program/mission achievements during 1996-1999, to be highlighted in the Strategic Plan include: a mission every 10 weeks for 70 weeks; the Galileo Europa mission; Space Technology (ST)-1 and the successful demonstration of Solar Electric Propulsion (SEP). Supplementing the major program/mission achievements is a longer list of major science achievements: evidence for the presence of oceans on Europa and Callisto; stronger evidence for an early Earth-like Mars; discovery of clouds in Titan's atmosphere; suggestion of water at lunar poles; and the low density of the asteroid Mathilde. Dr. Chyba described how the SSES has organized to address the strategic planning process. Five "campaigns" address what will be studied thematically—building blocks and our chemical origins; prebiotic chemistry in the outer solar system; formation and dynamics of Earth-like planets; evolution of Earth-like environments; and astrophysical analogs in the solar system. The planning is occurring at the Campaign Strategic Working Group (CSWG) level. Each CSWG has been charged to review the existing Strategic Plan in light of the main objectives, identify the key missions that contribute to that theme and define the goals for them, identify key technologies, prioritize the mission sequence, and work with the pre-project study teams to better define the missions. The CSWG's, with JPL, have been identifying technology initiative priorities. At the meeting this week, the SSES reviewed and discussed the results of the CSWG activities to date and a draft Solar System Exploration Technology Roadmap. More formal liaison is being established with the Sun-Earth Connections Advisory Subcommittee (SECAS) and the Origins Subcommittee (OS). The SSES is considering joint endorsements of key technologies identified by other Subcommittees, e.g., solar sail. There will be special sessions at the Lunar and Planetary Science Conference in March 1999, to get input from the broader community. Between now and May 1999 the SSES will achieve final convergence on the substance of the roadmap. There will be liaison meetings with the Technology Readiness Task Force in the late spring and summer. One of the objectives of the SSES is to interweave astrobiology into the roadmap. The SSES has formally designated two individuals to serve as liaison between the Astrobiology Roadmap group and the SSES strategic planning activities.

Sun-Earth Connection (SEC)

Dr. Andrew Christensen, Chair of the Sun-Earth Connection Advisory Subcommittee (SECAS), reported on its activities. The outline of the roadmap planning process and the “defining questions” is complete. The SECAS is still working on the provisional wording for two or three scientific goals, major science achievements, and major program achievements. Dr. Christensen described the SEC roadmap process. The Roadmap Team (RMT) is responsible for the preparation of the roadmap, and the Chair of the Team reported on the progress at the Subcommittee meeting earlier this week. There will be a Workshop in early March which will provide an opportunity for dialog with the community. There will also be community outreach at the AGU and AAS meetings in late May/early June. The draft roadmap will be reviewed by a subset of SECAS in late April. The final draft roadmap will be reviewed by the SECAS in July, with subsequent presentation to the SScAC. Dr. Christensen reviewed the previous roadmap quests and the evolution of concepts that is occurring. Preliminary quests for 1999 are: (1) How does the solar system interact with the galaxy? (2) How and why does the sun vary and how do the Earth and planets respond? and (3) What are the implications for life and humanity? The preliminary scientific goals reflect the quests.

Dr. Christensen stated that the joint meeting with the SSES was very valuable and a number of important scientific linkages between the two themes have started to develop. At its meeting, SECAS also identified several Explorer Program process issues: a proliferation of Co-Investigators; too many Category 4 proposals; the burden on Technical/Management/Cost/Other (TMCO) review imposed by having to do a full review of fifty management proposals; whether many Category 4 proposals should be Category 3; and discussion of the desirability of a two step process. For the last Mid-class Explorer (MIDEX), about one fourth of the proposals were Category 1; one-sixth were selected for Phase A. The Subcommittee felt that the Announcement of Opportunity (AO) should be clearer in some areas, particularly with respect to the science objectives. NASA would like to perform a TMCO review only on those proposals that are Category 1 in the science review; however, many members of the SECAS were opposed to this approach. The feedback that NASA provides to Principal Investigators (PI's) on the TMCO review is valuable for future proposal preparation. The SECAS began to discuss the two step process used by Discovery, and suggested that this process be considered for Explorer. Dr. Hertz indicated that the two step process has been used in the past for MIDEX, but the complaint from the community was that the yield of two out of eleven proposals was too low for industry to be willing to support the costs of Phase A studies. NASA Headquarters must be able to assess the feasibility of implementation. The main problem with TMCO is that the workload is not sustainable (not enough staff) given the frequency of AO's that are likely to be issued.

The SScAC felt that while some important issues were raised, it did not feel that a comment on the Explorer review process would be appropriate at this time. The review process could be on the agenda for a detailed discussion at a future meeting. In response to a question, Dr. Christensen indicated that there were presentations by the SECAS technologist at the Subcommittee meeting, and SEC is infusing technology into the roadmap from the outset. Dr. Hawkins commented that Education and Outreach must be considered explicitly in the Roadmaps. The Forum Directors should be used as a resource. They could identify one or two examples of major achievements in education and outreach opportunities for each theme. The Strategic Plan must also identify new opportunities for education and outreach, and these must be integrated into the roadmap plans as well.

Astronomical Search for Origins

Dr. David Black, Chair of the Origins Subcommittee (OS), discussed the status of strategic planning and some topics that emerged from the last OS meeting. The OS has formed four teams—astrobiology, stars/planets, galaxies, and technology—and has identified about a dozen significant science and mission/program accomplishments since publication of the last plan. The OS will trim this list to two to three each and send to Dr. Allen by the end of next week. OS will also look at education and outreach. Dr. Black described the Origins strategic planning process. Next steps to be taken by the Subcommittee include: arriving at agreement on the theme fundamental questions, goals, and objectives and tasking OS teams and various working groups to indicate how the candidate “notional” missions address the fundamental questions, goals, and objectives. The OS also discussed two key program issues at its meeting: long-duration balloons (LDB) and the Wide Field Planetary Camera (WFPC) 3-Infrared (IR) capability. The Subcommittee was very impressed by the potential of long-duration balloons for science and will recommend that the next AO for Small Explorer (SMEX) missions include balloon payloads. It was noted that long-duration balloons are a cross-theme capability. Dr. Chyba and Dr. Christensen indicated interest in having presentations on this topic at their next Subcommittee meetings. The Committee discussed the proposed OS recommendation. In response to a question, Dr. Withbroe noted that if an LDB were selected as a Mission of Opportunity, it would delay the next Explorer opportunity by some number of months. Does the scientific community really want to trade an orbital opportunity for a suborbital opportunity? Some of the SScAC members felt that comparing an LDB proposal against a MDEX proposal would require some kind of science-per-dollar assessment. Dr. Squyres suggested putting something positive about the LDB opportunity in the letter to Dr. Weiler and discussing the topic more fully at a later meeting. Another issue discussed at OS was the WFPC3-IR capability. The original concept was that spare parts could be used from WFPC1 to build a WFPC3 at a very low cost. The current issue is that there is now a groundswell of interest in adding an IR channel to the instrument. The additional cost is about \$35 million. The OS sees this as a potentially powerful scientific return for a modest investment and agreed that funding for this activity should be found within the Hubble Space Telescope (HST) project. If funding must be taken from other OS activities, the Subcommittee wants to hear about the plan and impact before making any recommendation to go forward. Dr. Squyres requested a report on the disposition of this item at the next SScAC meeting.

Structure and Evolution of the Universe (SEU)

Dr. Bruce Margon, Chair of the Structure and Evolution of the Universe Subcommittee (SEUS), reported on that Subcommittee’s activities. Recent science highlights chosen by the SEUS for possible inclusion in the new Strategic Plan were: extragalactic origin of gamma ray bursts; the identification of redshifted X-ray emission lines from the immediate vicinity of a massive black hole as a test of strong gravity; the discovery of magnetars; and the discovery of diffuse submillimeter background. The three SEU quests are: (1) to explain the structure in the Universe and forecast our cosmic destiny; (2) to explore the cycles of matter and energy in the evolving Universe; and (3) to examine the ultimate limits of gravity and energy in the Universe. Dr. Margon noted that the existing Roadmap is still relatively current. The Plan was only written 2 years ago and none of the major missions at the core of that Plan have flown yet. The next three major missions are: the Far Infrared-Submillimeter Space Telescope (FIRST), the Gamma

ray Large Area Space Telescope (GLAST), and Constellation X. All are in the current OSS Strategic Plan; however, only FIRST and GLAST are actually in the budget. With respect to the development of the SEU roadmap, there are nine working groups and a technology panel. The SEUS is relying heavily on the input from the discipline working groups. Between now and September, the SEUS will update the current roadmap (not a substantial activity); propose one or two new major mission candidates of very high science priority that can be done using near-term technology; include a few candidate missions with high science priority but for which the technology is not yet ready (candidate new starts in the 2008-2013 timeframe); and identify a few “vision” missions for consideration in the longer term. The SEUS will meet next in late May or early June to address priorities and again in the fall to reach a final consensus on the roadmap. With respect to other items of business, the SEUS was struck by the considerable amount of overlap with the interests of OS and will coordinate closely with OS over the summer to avoid duplication. Two particular SEUS concerns that may be of interest to SScAC were the adequacy of technology funding and the need for a budget line to support international opportunities. SEU is chronically short of technology funds; early investment is needed; and a few million dollars could make a huge difference in a number of missions, e.g., the Laser Interferometer Space Antenna (LISA). The good news is the growing pool of technology funds at NASA, but SScAC should stay well informed on the mechanism by which that budget is allocated and how it is split between meeting near-term and far-term needs and among categories. SEUS will address the issue of the absence of a funding line for international missions in its report. Dr. Withbroe noted that the reason why there isn’t an international line is that it is hard to “sell” a line that is a wedge—there must be content.

Report from the Technology Task Force

Dr. Daniel Hastings gave a status report on the Technology Readiness Task Force. Dr. Hastings and Dr. Christine Anderson are Co-Chairs of the Task Force. The Task Force will review the process and results of work being done by the technology teams within the themes. The technologists in the four themes have been asked to report back to the Task Force on the following questions: (1) Have missions and visions been articulated sufficiently to derive technology objectives and capabilities? (2) Have technology objectives and capabilities been described appropriately from missions and visions? (3) Have technology objectives and capabilities been well integrated across the four science themes? (4) Is the technology development currently planned in the various program elements appropriately scoped, scheduled, and funded to satisfy the strategic missions and visions of the Space Science Enterprise? At a video conference earlier this month, the Task Force adopted its final schedule. It will review the definition of missions and visions for each science theme and the relative technology requirements and needs in late June and report to the SScAC in July. At the videoconference, Dr. Hastings observed that the focus of the discussion was very NASA-centered. Much technology work is going on outside of NASA, and NASA needs to be aware of that work. The Task Force recommended that NASA place greater emphasis on leveraging technology developed by other organizations, e.g., DOD, DOE, etc. There are mechanisms in place for sharing technology and coordinating technology planning. The Committee asked Dr. Hastings to specifically address the issue of such coordination at the July meeting. Dr. Squyres observed that the Task Force and the Subcommittee strategic planning activities appear to be well connected and the structure is in place for ensuring that the Task Force activities are integrated into the overall strategic planning activity. Dr. Hastings suggested that the Subcommittees think

broadly about technology, and include considerations of cost, risk, and schedule. Dr. Hastings noted that a representative of the Office of Chief Technologist (OCT) attends the Space Technology Alliance (NRO, Air Force, Navy, NASA, Army, NEMA, etc.), which meets about once a month. There should be communication between this representative and the OSS technologists.

Research Program Report

Dr. Guenter Riegler, new Director of the Research Program Division, gave a status report on the Division staffing, the Research Program, and current issues facing the Division. There are a variety of workload issues needing resolution including how to best distribute the workload between the long-term and short-term staff. CY 1999 is a year of high turnover among IPA's/Visiting Scientists. At this time, the Division will need six new IPA appointments. The Division also hopes to be able to hire five new permanent civil service staff. Dr. Riegler noted that most of the workload is driven by the review process and there are few options for changing the review process without impacting the integrity of that process. Dr. Riegler stated that there needs to be more visibility for science results coming from the Research and Technology (R&T) and Data Analysis (DA) Programs, and this requires better science reporting from operating missions and from SR&T programs. Rebalancing of the research program will be a major task. Upper management wants to see a research program structure (and program content) which more closely matches the current strategic plan goals. A number of groups (the SScAC Task Force on Research and Analysis (R&A) and the National Research Council (NRC) Task Group on Research and Data Analysis) have recommended changes. Also, the structure of the SR&T and Mission Operations and Data Analysis (MO&DA) programs are very different across the various space science disciplines. Dr. Riegler invited SScAC comments on the content of the program and process for achieving this rebalancing. With respect to mission extensions, next year's Science Reviews will look at the large astrophysics missions as well as the smaller missions and will include a review of the effectiveness of science archives. One notable Division success has been the standardization of the NASA Research Announcement (NRA) process as embodied in the Research Opportunities in Space Science (ROSS) NRA. The Division has determined that "add-ons" can be made to the standard ROSS NRA throughout the year, thereby relieving the staff of the work required to prepare full NRA's to address new topics throughout the year. One continuing issue is uncoded carryover. Up to 50% of grants ask for no-cost extensions, and this level of carryover raises a number of uncomfortable questions. Dr. Squyres stated that SScAC has voiced a number of concerns with respect to the Research Program Division in the past, including the implications of the drawdown in staffing levels and the vitality and flexibility of the R&A program. He was pleased to see that the staffing appears to be moving in a positive direction. However, a response to the recommendations of the Task Force on R&A must be addressed at the next SScAC meeting.

Space Operations Management Office (SOMO)

Dr. Squyres noted that the NASA Advisory Council (NAC) will be taking a look at the SOMO issue and will make its own recommendations directly to Gen. Dailey and Mr. Goldin. Dr. Parkinson, Chair of the NASA Advisory Council (NAC), has asked Dr. Squyres to Co-Chair a small study group to develop a set of recommendations regarding SOMO to be presented at the NAC meeting in May. The group will include representatives from both the Office of Earth Science and OSS. The SScAC deliberations will be part of the OSS input into the study group

report. Dr. Squyres reminded the Committee that following the last meeting, a set of written questions were developed and given to Mr. Stan Newberry for preparation of his presentation today. He thanked Dr. Vondrak and Dr. Riegler for the work they had done in preparing these questions.

Mr. Stan Newberry responded to the SScAC questions on SOMO. The questions/issues addressed fell into two categories: (1) general concerns, including the benefits offered to OSS by SOMO/CSOC, the decision-making process, practices that need to be preserved during the SOMO transition, and budget optimization; and (2) specific questions related to recent SOMO actions, such as choice of services, transfer of budgets, and science oversight of data processing. Mr. Newberry stated that SOMO goals are to provide space operations services that are responsive to customers at the lowest cost to the Agency, transition space operations services to commercial providers, and restructure the management and operational processes using the concept of customer/service provider. The first specific SScAC question centered around the positive benefits of SOMO for science. The Committee was specifically concerned about ensuring that implementation of SOMO would not result in a reduction in space science productivity. Mr. Newberry claimed that streamlining and consolidation of existing mission operations functions, along with architecture improvements, would reduce the cost of mission operations. Some investment will be required for implementation of the Integrated Operations Architecture (IOA) and associated technology development required to assure that such savings will actually be realized. SOMO will work with OSS and other Enterprises to assure that the cost savings justify the investment. The responsibilities of Code O have been distributed to the Centers, and OSF was given the management role of the old organization. Centers still have the technical oversight of space operations services and are the primary customer interface.

With respect to the decision-making process, SOMO strongly supports the ability of science customers to make critical decisions that affect their mission and budget. SOMO services are being structured to provide options for levels of service quality, performance, and cost to enable customers to make system trades. The total SOMO budget is \$566 million in FY 99. This includes funding for development (TDRS spacecraft and launch services), operations, M&D upgrades, and technology. Operations include non-Consolidated Space Operations Contract (CSOC) elements, e.g., Dryden Flight Research Center, Canberra, Madrid, and Headquarters overhead. Mr. Newberry described how SOMO will involve customers in the making of decisions. SOMO is trying to put in place service-level agreements at the Project level. At the Enterprise level, the Space Operations Board of Directors is a forum for issues, customer feedback, and advocacy. SOMO and Enterprise representatives sit on this Board. SOMO plans to initiate Customer Forums at the Project/Field Center level within the new few months. There will be one on the East Coast and one on the West Coast. In response to a question, Mr. Newberry showed the representation on the SOMO councils and boards—the Space Operations Control Board (SOCB), the Lead Center Program Management Council, the Space Operations Board of Directors (SBoD), and the Space Operations Council (SOC). The SBoD promotes effective relationship with Enterprises, resolves and/or clarifies issues, and facilitates balanced responses to issues. The SOC is the policy group for SOMO.

With respect to the Deep Space Network (DSN), Mr. Newberry noted that DSN supports customers other than OSS. By treating all of NASA's space/ground communications assets

together and coordinating with commercially provided services, NASA missions can be supported with the greatest flexibility and the lowest cost. Mr. Newberry discussed the benefits of consolidation. NASA believes that life cycle costs can be reduced by sharing cross-trained staff, reducing overlapping functions, and using standardized commercial-based processes. In terms of budget optimization, full cost accounting should give missions the flexibility to convert savings in mission operation costs into mission extensions and increases in data analysis funds. Mr. Newberry noted that projected savings have already been removed from the SOMO budget. The reductions taken in the SOMO budget will not actually be achievable through consolidations until the investments required to implement those savings are made over the next few years. Reallocation of savings to mission extensions and data analysis will require some time to achieve.

Mr. Newberry described the Service Catalog. The Primary Service Level Agreement (PSLA) is used to order the services and is the basic agreement between CSOC and its customers committing to services and their cost. In order to ensure that CSOC services are properly incorporated into mission planning, SOMO will work with the Enterprises to support the development of the AO's. It will also support the Enterprises for review of the operations aspects of proposals. There will be a statement in future AO's that indicate NASA will consider broader NASA objectives in considering proposed approaches to mission operations, which may or may not result in NASA directing changes to the proposed approach/technical implementation or the proposed service provider for operations. If such changes should result in higher cost to individual missions, then the appropriate source of funds will be identified. With respect to decreases in out-year budgets, Mr. Newberry stated that SOMO has not arbitrarily reduced its own budget, but SOMO has been a popular target for budget reductions to accommodate other Agency needs. SOMO has been working and continues to work with the Enterprises to minimize the impact of budget reductions and to get customer input on priorities. Specific budget reductions will not be allocated until the options and impacts are discussed with the Enterprises and the specific projects that may be affected. All decisions will be reviewed by the Board of Directors.

With respect to science oversight of operations, Mr. Newberry indicated that SOMO will ensure that the type of problem that occurred with respect to the International Solar Terrestrial Physics (ISTP) Program will not happen again. Scientists at universities and NASA Centers will be involved in CSOC activities through Service Level Agreements and performance evaluation of CSOC. In terms of improving efficiency and cost, at least once a year, SOMO will conduct a review of each Service provided. Emphasis will be on reviewing commercial alternatives, and SOMO has a dedicated Commercialization Manager responsible for ensuring commercialization of SOMO services. Customers will be included in these reviews for requirements validation and input. In terms of OSS mission complexity, a key driver for the SOMO architecture is the ability to assure that the diverse set of complex missions currently supported, as well as a realistic projection of mission support for the next ten years, has been accommodated. As the SOMO moves forward with the system design review, more specific information will be available concerning CSOC's ability to meet projected mission requirements.

SScAC Questions/Discussion with Mr. Newberry:

Dr. Black: How will SOMO help force the evolution of the infrastructure so as to drive the cost down? Mr. Newberry: The Agency needs to move toward commercial services, but achieving this goal will take an Agency effort working with the field Centers and external stakeholders. Such a transition will be difficult, and there is not a clear plan at this time on how that transition will actually occur.

Dr. Smith: Are cost savings actually being realized, or are budgets merely being cut? Mr. Newberry: The budget was cut based on the assumption of cost savings. NASA will not save money with CSOC in the first year. The savings (budget reductions) made to date have already gone elsewhere in the Agency. SOMO must achieve cost reductions to meet the budget targets.

Dr. Withbroe: What about risk, e.g., the Solar and Heliospheric Observatory (SOHO) incident? Are we putting billions of assets at risk to save a few dollars in operation? Mr. Newberry: This is a question that everyone needs to address. If too much risk is being put on the system, it must be flagged and discussed.

Dr. Urry: How can SOMO reduce costs and continue provide quality service? Mr. Newberry: The customer's objective is paramount to what SOMO is trying to do. The objective is to provide the same quality and level of service at a lower cost. It is up to the Enterprise and customer to decide the level of service required for the science.

Dr. Richstone: On HST, the innovations were driven by the customer. In the SOMO model, the end customer appears to be rather removed from the operation. Over the long term, where do innovations in operations strategy come from? Mr. Newberry: There is still a role for SOMO to support innovations driven by the customer. The Agency should still invest in this kind of effort.

Dr. Black: Re risk—the SOC is the place where risk of assets (and associated policy implications) should be addressed. This issue needs to be worked through the system, starting at the Center level. The risks associated with this new approach must be well understood.

Dr. McCleese: Who is responsible for the architecture? Who creates and evolves it? Mr. Newberry: Within SOMO, there is a system engineering working group. For the first year, the Chair is Mr. Dick Matheson at JPL (chairmanship rotates among the Field Centers). This group helps make the trades. There is also a technology working group responsible for technology infusion into the architecture. Q: When a budget reduction is made, how does SOMO determine whether services are really being maintained or whether the reduction went too far? A: The metrics associated with providing those services have been identified and tracked. Feedback comes from the people managing the network. The new 7120 Program Management Handbook has identified such responsibilities Agency-wide.

Dr. Christensen: Part of the unease of this Committee with the SOMO/CSOC approach is experience with support organizations that move away from the user control. How does SOMO plan to address the responsiveness/support issue? Mr. Newberry: SOMO has to clearly demonstrate to the user how they can be helped, or the approach will fail.

Dr. Chyba: Re risk—we suggest that some type of ongoing, systematic risk assessment on this issue be considered. The machinery must be in place at the Centers to enable them to provide a realistic risk assessment.

Dr. Black: Consider some sort of external review process.

Dr. Squyres: Regarding the budget chart—the space science budget is increasing, and there will be more missions flying in the same timeframe that the SOMO budget is decreasing. Are mission operations being jeopardized? If operations are divorced from flight projects, the fear is that the goal of achieving cost savings may become an end in itself and fail to adequately support customers. Mr. Newberry: SOMO is concerned about adequate safeguards being in place to

ensure that every project is supported adequately and not subjected to unacceptable risks. The concept of Service Level Agreements is an attempt to address this issue. The budget profile for operations shown would exist whether or not there was a SOMO. SOMO needs to assess the profile with the implementation plan that has been devised. These issues will be worked with the Field Centers and the Enterprises. CSOC must continue to have the capability to respond to spacecraft emergencies and retain the right skill mix to do it.

Dr. Black: NASA cannot continue to rely on a lot of people on the ground doing operations.

Dr. Smith: Is the CSOC contractor meeting the cost claims that were originally projected? Mr.

Newberry: SOMO will stay on top of tracking costs.

Thursday, February 25

OSS Program and Budget Status

Before beginning his presentation, Dr. Edward Weiler, Associate Administrator for Space Science, introduced Mr. Roy Bridges, Director of the Kennedy Space Center (KSC), who officially welcomed the SScAC to the Space Coast.

Dr. Weiler discussed the recent announcement regarding a possible emergency servicing mission for the Hubble Space Telescope. The HST "rule book" developed before the mission was even launched contains procedures for a "call up" mission under the present circumstances. He noted that if one more gyro fails, there would be no science until the servicing mission. Such a call-up mission would change out four of the six gyros and do some of the other routine servicing that was scheduled for the next servicing mission. The crew is ready to go should there be a call-up mission. Even with such a mission, there would still be a HST servicing mission in December 2000.

Dr. Weiler reviewed the status of the current OSS Program and budget. Some recent accomplishments include seven successful launches over the past five months, including the February launch of Stardust. Upcoming highlights include the launch of TERRIERS in April, FUSE in May, and AXAF in July. Notable science highlights include observations of the faintest objects in the Hubble Deep Field and the discovery of magnetars. Most missions in development or operation are going well, with the exception of the Advanced X-ray Astrophysics Facility (AXAF), Astro-E, and Gravity Probe (GP)-B. The Stratospheric Observatory for Infrared Astronomy (SOFIA) has problems associated with the schedule for the delivery of the German telescope and will slip about 6 months. On AXAF (the Chandra X-ray Observatory), there have been major problems with the PC boards (four or five boards had to be replaced), and further slips are likely. The new projected launch date is July 9, 1999; and, so far, everything is on schedule for this date. All of the AXAF slips since August 1998 will cost \$62 million. The impact of AXAF delays on the HST servicing missions will cost another \$40 million. These costs are placing considerable stress on the OSS budget. On February 2, 1999, SOHO resumed making scientific observations and is now in good shape. GP-B is not meeting technical milestones, and there could be a significant cost overrun in FY 2000. Dr. Weiler noted that the FY 2000 budget was the result of many iterations between NASA and OMB. The FY 2000 budget contains augmentations for the following: Mars Network, Mars Micromissions (with the first mission being a Mars airplane) self-sustaining robotic networks, Gossamer

Spacecraft, and next decade planning. Although the Agency budget is flat in real year dollars, the Space Science budget has an increasing slope over the next 5 years. Dr. Weiler compared the FY 2000 Space Science budget runout with budgets since 1995. Almost all of the Strategic Plan missions are in the current budget. He emphasized that every theme has major content in it that it did not have 2 years ago. Dr. Weiler showed the budget distribution by major activity. Dr. Weiler commented that the FY 1999 budget contained earmarks of \$82 million, directed reductions of about \$9 million, and an appropriations increase of about \$61 million. OSS was able to cover the total FY 1999 shortfall from MO&DA carryover, AXAF MO&DA (as a consequence of the launch delay), and the Discovery Program. The Discovery Program was not actually impacted because of the launch schedule for selected missions which have not yet gone into development. In the FY 2000 budget, OMB added \$44 million in new program content, but this new work was accompanied by some reductions—a delay in Constellation X, decreases in Cassini MO&DA and other MO&DA, reductions in funding for deep space systems (technology) and space solar power, Explorers, Discovery, elimination of support for Spectrum X-Gamma, and other transfers that did not impact OSS.

Dr. Weiler reviewed the SScAC recommendations from the last meeting. Most of the recommendations were addressed in briefings at this meeting. With respect to staffing, eleven OSS vacancies are in the process of being filled. There is an opening for a senior astrobiology person. Some consideration is being given to having a fifth Science Director for the cross-cutting theme of life in the universe; another option is to have this person be a Special Assistant for Astrobiology to the Associate Administrator. Dr. Weiler invited comments on the desirability of various approaches. Dr. Weiler announced the selection of Dr. Guenter Riegler for the position of Director of the Research Program Division. He indicated that he would continue to try to get as many Intergovernmental Personnel Assignments (IPA's) as possible. In response to a question on AXAF, Dr. Weiler indicated that AXAF will not be launched until it is ready; it is extremely important to the future of the OSS program, and it would be foolish to take unnecessary risks. Dr. Squyres raised an issue related to budgeting for international missions, specifically, the need for a budget line which would provide flexibility to take advantage of new opportunities. Dr. Weiler noted that the history of supporting international missions has been varied. Some collaborations have been worked at the highest levels and have been built into strategic planning. In the future, Discovery and Explorer Program AO's will contain provisions for proposing to participate on international missions as a Mission of Opportunity. Such missions will be selected competitively. This approach has been discussed with the Japanese and the Europeans. It would also be very difficult to sell a "reserve" line within the Agency. For major U.S. collaborations, missions should come up through the Strategic Planning process, e.g., the Next Generation Space Telescope (NGST) and the Mars Program. With respect to ground-based astronomy, the OSS policy is that NASA will not fund new ground-based astronomy work in the future. However, OSS will continue to support programs already in place. With respect to the Space Station, some OSS science will be able to be done there, e.g., cosmic ray physics; and OSS is fully supportive of doing appropriate science on the Space Station when it becomes clear that the flight of such science is a real opportunity. Explorer and Discovery AO's will be opened up to Space Station payloads at such a time.

Dr. Squyres thanked Dr. Weiler for maintaining the present positive budget trend and being sensitive to issues concerning program balance.

Theme Status Reports:Solar System Exploration (SSE)

Dr. Carl Pilcher briefly reviewed the SSE Program. The last several months have been a particularly exhilarating period. Since October 1998, there have been five missions launched (on four launch vehicles)—Deep Space 1, Mars Climate Orbiter, Mars Polar Lander/Deep Space 2, and Stardust. All of the missions are functioning extremely well. Exciting recent science results include the discovery of evidence for active polar processes on Mars and for the presence of subsurface oceans on Europa and Callisto. SSE has made some highly visible commitments on the Mars Program, and meeting those commitments will be a challenge. There will be a meeting next week on the Mars architecture to examine technical issues, costs, etc. OSS is going to have to go forward with an architecture that can actually be implemented. There have been concerns about data needs and planetary protection. SSE is working to build the funds for Data Analysis into the program. The National Academy of Sciences (NAS) and the Planetary Protection Task Force will be advising on sample return and planetary protection issues. The Europa Orbiter mission will also be challenging. Radiation issues associated with operating a spacecraft in the harsh Europa environment and use of nuclear power are two prominent issues that will have to be successfully addressed. Dr. Pilcher commented on the science that could be enabled by the Mars airplane. This mission would be analogous to Mars Pathfinder, focusing on demonstrating the micromission concept and delivery of an entry vehicle into the atmosphere. It would demonstrate the applicability of the technology to future airplane missions. Science return would be an important but secondary objective.

Sun-Earth Connection (SEC)

Dr. George Withbroe reviewed the SEC program. SOHO is back in operation, and there is sufficient fuel for another 10 years of operation. This will allow study of the interior of the Sun over the full solar cycle. There are two major science stories being published this month—detection of the source regions of solar wind by SOHO and a set of magnetic observations made by the Transition Region and Coronal Explorer (TRACE). The next solar-terrestrial probe mission is Solar B. It will provide a major advance in capability, e.g., a factor of 10 higher spatial resolution of solar magnetic fields. It will help address the fundamental question: How does solar variability impact life and society? Other future missions include: Solar Probe, the Solar Terrestrial Relations Observatory (STEREO), and the Magnetospheric Multiscale and Global Electrodynamics missions. In response to a question, Dr. Withbroe noted that there is a joint program with Earth Science on global climate change. Establishing more cross-links between the two Enterprises will be an important future activity.

Astronomical Search for Origins (ASO)

Dr. Harley Thronson reviewed the ASO program. He showed infrared images from the Near Infrared Camera and Multi-Object Spectrometer (NICMOS) of young stars in the nearby Taurus star-forming region. He noted the public outreach site usage is currently equivalent to about half the daily circulation of the New York Times. Some recent activities within Origins include: plans for the HST servicing missions (already discussed by Dr. Weiler); completion of the Space Infrared Telescope Facility (SIRTF) key milestones; completion of launch readiness tests for the Wide Field Infrared Explorer (WIRE); completion of satellite integration and environmental

testing of the Far Ultraviolet Spectroscopic Explorer (FUSE); selection of industrial partners (Lockheed Martin and TRW) for the Space Interferometry Mission (SIM); the completion of pre-Phase A architectural studies and a signed letter of agreement between ESA and NASA on NGST; progress on the outrigger telescopes for the Keck Interferometer; completion of telescope and observatory PDR's on SOFIA; completion of the NASA Astrobiology Institute (NAI) implementation plan; and completion of explanatory materials on the Terrestrial Planet Finder (TPF). TPF will be a major program under consideration by the Decennial Review Committee. In response to a question on the Astrobiology Institute, Dr. Thronson stated that the groundbreaking for the Carl Sagan Astrobiology Laboratory—intended to house the Sagan archives—will be this spring. The planned existence of a physical laboratory in no way compromises the intention to have a “virtual” institute. The Carl Sagan Laboratory could satisfy the needs for “hands-on” experiments, where members of the virtual institute could come to work together for short periods of time. This topic was discussed further by Dr. Weiler later in the meeting.

Structure and Evolution of the Universe (SEU)

Dr. Paul Hertz reviewed the SEU program. He discussed the recent gamma-ray burst on January 23, which was particularly bright. This was the first time that the optical transient associated with a gamma-ray burst was actually detected. Keck captured an early optical image, and HST captured an image of the host galaxy and the fading optical transient. Recent MIDEX proposals selected for Phase A studies are: Swift Gamma Ray Burst Explorer; Full-sky Astrometric Measurement Explorer; Advanced Solar Corona Explorer; Auroral Multiscale MIDEX, and the Next Generation Sky Survey. Downselect will take place later this year following completion of the Phase A studies. Dr. Hertz provided updates on GLAST. Three teams are being funded for technology development. The GLAST AO release is planned for June 1999 in order to support an FY 2002 new start and a launch in 2005.

Following the Science Theme Directors' presentations, the SScAC discussed several issues related to astrobiology. With respect to construction of facilities, Dr. Weiler noted that Mr. Goldin had made a decision that the work of Carl Sagan should be captured in a facility and that this facility could house the core team for the Astrobiology Institute as well. He noted that no commitment had actually been made to build a building and that funding for such a building would have to be identified in future budgets. Since funds for construction of facilities must now come out of the program budgets, Dr. Weiler has suggested that Dr. McDonald follow the model of the Space Telescope Science Institute (STScI)—namely, locate sponsors to build facility, which NASA would then lease. Its primary purpose would be to house world-class unique astrobiology instruments (not routinely available to astrobiologists in the country) that would then be available as national resources and a facility for astrobiological research as well as the Sagan library. As a secondary function, it would house the core support team for the astrobiology institute staff. ARC has the action to put a plan together for the development of the facility. Dr. Morrison emphasized that the Carl Sagan Laboratory is not specifically for the Astrobiology Institute; however, the SScAC felt that the natural tendency would be to force the Institute in the direction of making use of such a facility.

The SScAC had reservations about the idea of creating a Science Theme Director for Astrobiology. Some of the members felt that from a management perspective, there potentially

were problems—budgetary control (for the Astrobiology Theme Director), and a confused reporting and program relationship with the rest of the current OSS organization. The other communities might view astrobiology as having “two votes.” Dr. Pilcher added that addition of a Science Director for Astrobiology would not necessarily create a fifth theme but would emphasize the importance of astrobiology. Dr. Weiler noted that a related issue is that Mr. Goldin wants a full-time senior person working on planetary protection, and he was concerned about the size of the OSS “front office” staffing level.

SScAC has also expressed concern in the past about the organizational structure of the Astrobiology Institute and the difficulty of getting an Institute Director. Dr. Weiler stated that the Director has very clear lines of reporting similar to the arrangements that now exist for the Space Telescope Science Institute—daily business issues (financial, grants management, facilities, etc.) are under ARC control; matters of science policy, budget, and direction are under the Origins Director. In addition, there will be a high level, world class group of biologists and astrobiologists on a standing oversight Committee reporting to the Associate Administrator on how the Institute and Director are performing. With respect to the selection of the NAI Director, there has been a problem getting a candidate who is a world-class biologist (a mandate from Mr. Goldin), and two searches to date have basically failed. Dr. Weiler noted that ARC has proposed selection of a senior world-class biologist for a year or two to get the Institute started while taking more time to find a permanent candidate. This was the course that was now being pursued. Dr. Weiler added that it was obvious from the discussion that there needed to be a thorough briefing on both the Astrobiology Program and the Astrobiology Institute at the next SScAC meeting.

In summary, the SScAC felt that it would benefit from a thorough Astrobiology presentation at the next meeting. The SScAC recommended the idea of an Astrobiology Theme Director be put in abeyance. The substance of the discussion on the Astrobiology Institute and Director were identified as items to be addressed in the letter from Dr. Squyres to Dr. Weiler.

Committee Discussion

With respect to SOMO, the Committee noted that it had appreciated Mr. Newberry’s presentation and would like to see more of the type of interaction and communication that was demonstrated in the presentation and discussion with Mr. Newberry. The SScAC identified several points requiring further consideration and possible action. Organized feedback mechanisms from the science community are desperately needed. Establishment of an external oversight group (users and operations experts) at the SOC level should be considered, as should splitting DSN out from SOMO since OSS is almost the only customer for the DSN. Based on the SOHO experience, risk is an issue; and there is also a need for an external group to carry out a detailed risk analysis. The budget profile for SOMO—the Agency is drastically decreasing the funds for operations—is a major concern. Dr. Riegler noted that there are no CSOC savings in the first 4 years; savings are supposed to be realized in years 5-10. It does not appear that, realistically, mission managers will have freedom of choice concerning use of CSOC services. Mission managers should be empowered to make choices at their level that deal with science in the most cost-effective manner. It appears that feedback and control mechanisms are missing from SOMO. High level boards set policy, but don’t adequately decide implementation details. The SScAC felt that SOMO should consider various mechanisms at the customer level to

provide a better connection, e.g., a users group for SOMO and a group to feed information back to the SOC. SOMO is also not in a position to address tradeoffs between development and operation costs and to optimize the full life cycle costs of a mission. A “one-size-fits-all” menu for providing services is too naïve, since many OSS missions have special operations requirements. The concern is whether OSS will lose flexibility to operate many different kinds of missions and whether the scientists will be isolated from mission operations to a greater extent than they are now. Taking budget cuts before a cost savings is actually realized seems to reflect management by wishful thinking and has the potential to drastically affect the science coming out of missions.

Dr. Squyres noted that the NAC has requested that the SScAC provide a set of recommendations that are as specific as possible rather than just expressing vague concerns. One approach would be to identify where the failure modes are; ways to prevent failure, etc. The main issue is that OSS and the missions must be treated as the customers of SOMO/CSOC—Mission Managers need to have control of resources, choice of vendors/options, itemized billing, and feedback ability (a process for registering complaints, making corrections). The SScAC felt that there is also a good case for splitting DSN out from under SOMO.

In summary, the SScAC felt that Mr. Newberry was responsive to the Committee’s request for a detailed presentation on and discussion of SOMO. There was a general sense that there is no point in arguing against SOMO and the CSOC structure. Those decisions have already been made. SScAC will work with the Agency to try to make SOMO a success. Some constructive points were: (1) there is a concern that in an era of decreasing operations budgets that some very valuable assets could be put at risk and having some kind of ongoing oversight looking at mission safety issues would be advisable; (2) DSN is a special case and does not belong under SOMO; (3) Project/Program Managers need to have some degree of freedom of choice; and (4) there needs to be a mechanism for direct feedback by users into the system, and an external assessment group to report on SOMO at the Associate Administrator level should be created. As it stands—particularly given the budget pressures—it is far from clear that users will have many options other than CSOC, and the contractor must be held accountable for the quality of its performance. Appropriate metrics should be developed, and statistics must be kept.

Report from the Planetary Protection Task Force (PPTF)

Dr. John Rummel, NASA’s Planetary Protection Officer, reported on the plans for the recently established Task Force. The purpose of the planetary protection policy is to preserve biological and organic conditions for future exploration and to protect the Earth from potential extraterrestrial contamination. This policy applies to all NASA missions to planetary bodies or those that return to Earth from a target of exploration. Non-NASA missions with NASA participation must follow COSPAR policy. The PPTF was established to provide SScAC with findings and recommendations on programs, policies, plans, and other matters pertinent to NASA’s responsibilities for planetary protection. The PPTF will be looking intensively at issues associated with Mars exploration. It will assess the structure and level of future advisory activities related to planetary protection in the next decade. The PPTF will also recommend appropriate assignment of missions to small bodies of the solar system with respect to the framework provided by the Space Studies Board (SSB). The PPTF will have its first meeting in March, a report on a recommended advisory structure for planetary protection by September

1999, and a final report around March 2000. Dr. Rummel reviewed the diverse membership of the PPTF and the agenda for the first meeting. Membership has representation from various agencies that have interest in sample return and regulation. Dr. Norine Noonan will be the Chair. With respect to conflicts of interest, Dr. Rummel noted that what the PPTF wants to avoid is having people on the Task Force who have budgetary concerns with meeting planetary protection requirements. SScAC felt that NASA has put together an outstanding group of people on the PPTF to consider this critical issue.

Technology Program Highlights and Issues

Dr. Peter Ulrich reviewed the OSS response to the SSB report on technology that was released last fall. A number of the recommendations directly deal with actions to be taken by OSS. Many of the recommendations have been overtaken by subsequent events, and current status will be discussed with the SSB. SSB recommendations (and current status where appropriate) are as follows: (1) The program should be formally evaluated within 12 months of the issuance of the report. NASA proposes to meet with the committee on April 28 to update them on actions that have already occurred. The meeting in April may satisfy the requirement for the review. (2) The planning process for cross-enterprise technology development should be modeled on the process that OSS uses for its planning, (e.g., roadmapping). OSS is not sure that this recommendation still applies; it will be revisited with the committee at the April meeting. (3) Establish a process to evaluate Center core competencies as a basis for deciding whether to do technology work internally or externally. OSS has been working through the Management Operations Working Group (MOWG) to agree on a uniform review process for evaluation of Center excellence and core competencies, and progress is being made. (4) For technology that supports a near-term mission, leave the make or buy decision up to the Center Project Manager with concurrence by Headquarters on a Center plan to “make.” NASA Headquarters should guarantee nonconflict of interest on a decision to “buy” by acting as the selecting official for the competition. (5) Ensure that adequate resources, especially personnel, are available at Headquarters to respond to the need for increased competition for ATD procurements. (6) Foster increased workforce mobility (cross Center cooperation, IPA assignments, etc.). OSS is trying to encourage this, but it is difficult to get people who have the required skills to move around. (7) Establish an archival data base on technology investment. The Agency now has a technology inventory. (8) To ensure accountability, formally respond to the recommendations. This has been done via a general letter from the Associate Administrator, and the April meeting will be another formal response to the SSB. Reports will also be given to the SScAC and the NAC as requested.

In response to a question, Dr. Ulrich indicated that the five new budget items (noted earlier by Dr. Weiler) will be managed out of the Advanced Technology and Mission Studies (AT&MS) Division. The Cross-Enterprise Technology Program is holding a customer strategy meeting next week. Customer representatives and the Thrust Area Managers (TAM’s) will begin a continuing series of dialogs on requirements from the customers and opportunities in the technology world. The Subcommittees have been briefed on the Technology Readiness Task Force. Dr. Squyres raised an issue that was mentioned earlier—an impression (by Dr. Hastings) that NASA may not be adequately aware of the technology efforts in the Air Force and the NRO. Dr. Ulrich noted that at the organizational videoconference, the presentations were very NASA-centric; however, the TAM’s were selected in part on the basis of their familiarity and experience with technology outside of the Agency. The TAM’s have a broad view of technology

and are charged with ensuring that these broad connections are made. In response to a question, Dr. Ulrich indicated that the NRA calling for technology proposals for the Cross-Enterprise Program will have a broad scope. The Plan is to issue three NRA's in 3 years. The first, to be issued in FY 1999, will solicit proposals for a \$10 million/year activity over 3 years. This will be followed by two additional NRA's (in 2000 and 2001) each for \$20 million/year over 3 years. The first solicitation will be restricted to non-NASA PI's only, but NASA people can team with the Principal Investigator from an outside organization. Subsequent NRA's will be open to proposers from all institutions.

Dr. Black reported on two Space Station topics that came out of the Space Station Utilization Advisory Subcommittee (SSUAS) which met earlier in February. (1) Attached payloads—concern was expressed about opportunities; and (2) the Telescience Resource Kit (TReK), which is a capability for remote payload operations for Space Station users. Dr. Black will make further inquiries and send information to Dr. Squyres. Dr. Black noted the need to appoint a new SScAC liaison to the SSUAS and indicated that he would follow up with Dr. Margon on this subject.

Friday, February 26

The SScAC discussed the following topics for inclusion in the letter to Dr. Weiler (included as Appendix D to this report):

- 1) Response to recommendations from past SScAC meetings
- 2) Status of the Strategic Planning efforts
- 3) Brief statement on balloon technology and the promise of long duration ballooning
- 4) R&A issues/progress on staffing
- 5) Astrobiology
- 6) SOMO

Conclusion of Meeting

All of the SScAC members were pleased with the exchange of information and results of this meeting. In response to a request from Dr. Squyres for the Committee members to make final remarks, several of the members expressed concern with the technology budget. Technology is the fastest growing part of the OSS budget, and the SScAC needs a more complete analysis of the technology budget and the way that budget is being used at future meetings. The SScAC should scrutinize this area as much as it does the themes, and there should be an assessment of this program against OSS objectives. It was also agreed that there should be a more detailed discussion about the Cross-Enterprise Technology Program at a future meeting. The large technology wedge captures everything that needs to happen prior to a new start for a mission, and it would be useful to assemble a complete picture for this group for review and discussion. It is crucial that education and public outreach be integrated into the Strategic Plan and not just treated as an adjunct. Representatives from each of the Forums need to be involved with the Subcommittees in their strategic planning activities. The members felt that the SScAC needs to track the development of the Astrobiology Program and stay regularly informed. OSS needs to respond to the R&A and MO&DA Task Force recommendations, including what the changes are and how they will be implemented. This should be addressed at next meeting. The SScAC should continue to follow SOMO, and assess the consequences of SOMO actions. Dr. Pilcher

added that without community base and support, the OSS program would not come together. He expressed appreciation for all of the comments and efforts of the SScAC.

The date for the next SScAC meeting is: July 28-30 at NASA Headquarters. The fall Strategic Planning Workshop will be held on 4 days during the week of November 1 at a location to be determined.

Agenda
Space Science Advisory Committee Meeting
Radisson Resort,
Cocoa Beach Florida
February 24-25-26, 1999

Wednesday, February 24

8:15AM	Opening Remarks/Announcements	Squyres
8:30	FY 2000 Strategic Plan Schedule and Status	Allen
9:00	Subcommittee Progress on Strategic Planning	
	- Solar System Exploration	Chyba
10:00	- Sun-Earth Connection	Christensen
11:00	- Astronomical Search for Origins	Black
NOON	Working Lunch	
1:00 PM	- Structure and Evolution of the Universe	Margon
2:00	Report from the Technology Task Force	Anderson/Hastings
	- Integration of Technology into the Strategic Plan	
2:30	Research Program Report	Riegler
2:45	Space Operations Management Office (SOMO)	Newberry
3:45	Discussion	
4:30	General Discussion/Review of Key Issues	
5:30	ADJOURN	
6:30	Group Dinner—Mango Tree	

Thursday, February 25

8:00 AM	Announcements	Squyres
8:15	OSS Program and Budget Status	Weiler
9:30	Discussion	
10:30	Theme Status Reports (15 minutes each)	
	- Solar System Exploration	Pilcher
	- Sun-Earth Connection	Withbroe
	- Astronomical Search for Origins	Thronson
	- Structure & Evolution of the Universe	Hertz
11:30	Discussion	
NOON	Working Lunch/Continued Discussion with AA	
1:15 PM	Report from the Planetary Protection Task Force	Rummel
1:45	Discussion	
2:30	Technology Program Highlights and Issues	Ulrich
3:00	Committee Discussion/Preparation of Recommendations	
5:30	ADJOURN	

Friday, February 26

8:30 AM	Announcements	
9:00	Continued Discussion/Preparation of Recommendations	
11:30	Plans for the Next Meetings	Squyres
NOON	ADJOURN	

SPACE SCIENCE ADVISORY COMMITTEE
Membership List

Dr. Steven W. Squyres (*Chair*)
428 Sciences Building
Cornell University
Ithaca, NY 14853-6801
Tel: 607-255-3508
FAX: 607-255-5907
Email: squyres@astrosun.tn.cornell.edu

Ms. Christine M. Anderson
Director, Space Vehicles
Air Force Research Laboratory
3550 Aberdeen Ave., SE
Kirkland AFB, NM 87117-5776
Tel: 505-846-6243
FAX: 505-846-6689
Email: anderson@plk.af.mil

Dr. David C. Black
Director, Lunar and Planetary Institute
3600 Bay Area Boulevard
Houston, TX 77058
Tel: 281-486-2138
FAX: 281-486-2173
Email: black@lpi.jsc.nasa.gov

Dr. Andrew B. Christensen
The Aerospace Corporation
P. O. Box 92957
Los Angeles, CA 90009
Tel: 310-336-7084
FAX: 310-336-1636
Email: andrew.b.christensen@aero.org

Dr. Christopher F. Chyba
Carl Sagan Chair for the Study of Life in
the Universe
SETI Institute
2035 Landings Drive
Mountain View, CA 94043
Tel: 650-961-6633
FAX: 650-961-7099
Email: chyba@seti.org

Dr. David J. Des Marais
Senior Research Scientist
Exobiology Branch of the Space Science Div.
NASA/Ames Research Center
Moffett Field, CA 94035-1000
Tel: 415-604-3220
FAX: 415-604-1088
Email: ddesmarais@mail.arc.nasa.gov

Dr. Robert D. Gehrz
Department of Astronomy
University of Minnesota
116 Church Street, SE
Minneapolis, MN 55455
Tel: 612-624-7806
FAX: 612-626-2029
Email: gehrz@astl.spa.umn.edu

Professor Daniel E. Hastings
Chief Scientist, USAF
Room 4E320
1075 Air Force Pentagon
Washington, DC 20030-1075
Tel: 703-697-7842
FAX: 703-697-5154
Email: hastingdsd@execnet.hq.af.mil

Dr. Isabel Hawkins
Space Sciences Laboratory, MC 7450
University of California, Berkeley
Grizzly Peak at Centennial
Berkeley, CA 94720-7450
Tel: 510-643-5662
FAX: 510-643-5660
Email: isabelh@ssl.berkeley.edu

Dr. Klaus Keil
Director, Hawaii Institute of Geophysics and
Planetology
School of Ocean and Earth Science and
Technology
2525 Correa Road
University of Hawaii at Manoa
Honolulu, HI 96822
Tel: 808-956-8760/61
FAX: 808-956-3188
Email: keil@kahana.pgd.hawaii.edu

Dr. Edward W. Kolb
Theoretical Astrophysics, MS 209
Fermi National Accelerator Laboratory
Wilson and Kirk Road
Batavia, IL 60510-0500
Tel: 630-840-4695
FAX: 630-840-8231
Email: rocky@rigoletto.fnal.gov

Dr. Molley K. Macauley
Senior Fellow
Resources for the Future
Room 613
1616 P Street, NW
Washington, DC 20036
Tel: 202-328-5043
FAX: 202-939-3460
Email: macauley@rff.org

Dr. Bruce H. Margon
Department of Astronomy
University of Washington
Box 351580
Physics and Astronomy Building
Seattle, WA 98195-1580
Tel: 206-543-0089
FAX: 206-685-0403
Email: margon@atlas.astro.washington.edu

Dr. Daniel J. McCleese
Caltech/Jet Propulsion Laboratory
MS 183-335
4800 Oak Grove Drive
Pasadena, CA 91109-8099
Tel: 818-354-2317
FAX: 818-393-6546
Email: djmcc@scn1.jpl.nasa.gov

Professor Richard A. Mewaldt
Mail Code 220-47
Downs Lab
Space Radiation Laboratory
California Institute of Technology
1200 East California Blvd.
Pasadena, CA 91125
Tel: 626-395-6612
FAX: 626-449-8676
Email: mewaldt@srl.caltech.edu

Dr. Douglas O. Richstone
Department of Astronomy
University of Michigan
830 Dennison Building
500 Church Street
Ann Arbor, MI 48109-1090
Tel: 734-764-3466/3440
FAX: 734-763-6317
Email: dor@maia.astro.lsa.umich.edu

Dr. William Smith

Dr. C. Megan Urry

Associate of the Universities for Research in
Astronomy
Suite 350
1200 New York Avenue
Washington, DC 20005
Tel: 202-483-2101
FAX: 202-483-2106
Email: wsmith@smtp.aura-astronomy.org

Head of Science Program Selection Office
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218
Tel: 410-338-4593
FAX: 410-338-4767
Email: cmu@stsci.edu

Dr. Richard R. Vondrak
Chief, Laboratory for Extraterrestrial Physics
Space Science Directorate
NASA/Goddard Space Flight Center
Greenbelt, MD 20771
Tel: 301-286-8112
FAX: 301-286-1683
Email: vondrak@lepvax.gsfc.nasa.gov

Dr. Jeffrey D. Rosendhal (*Executive Secretary*)
Assistant Associate Administrator for
Space Science (Education and Outreach)
NASA Headquarters, Code S
Washington, DC 20546-0001
Tel: 202-358-2470
FAX: 202-358-3092
Email: jrosendh@hq.nasa.gov

SPACE SCIENCE ADVISORY COMMITTEE

Cape Canaveral, FL

February 24-26, 1999

MEETING ATTENDEES

Committee Members:

Squyres, Steven (<i>Chair</i>)	Cornell University
Black, David	Lunar and Planetary Institute
Christensen, Andrew	The Aerospace Corporation
Chyba, Christopher	SETI Institute
Gehrz, Robert	University of Minnesota
Hastings, Daniel	US Air Force
Hawkins, Isabel	University of California, Berkeley
Keil, Klaus	University of Hawaii at Manoa
Kolb, Edward	Fermi National Accelerator Laboratory
Margon, Bruce	University of Washington
McCleese, Daniel	Caltech/Jet Propulsion Laboratory
Mewaldt, Richard	California Institute of Technology
Richstone, Douglas	University of Michigan
Smith, William	AURA
Urry, C. Megan	Space Telescope Science Institute
Vondrak, Richard	NASA/Goddard Space Flight Center
Rosendhal, Jeffrey (<i>Executive Secretary</i>)	NASA Headquarters

NASA Attendees:

Allen, Marc	NASA Headquarters
Bergstralh, Jay	NASA Headquarters
Betts, Bruce	NASA Headquarters
Calabrese, Mike	NASA/GSFC
DeVincenzi, Don	NASA/ARC
Gershman, Bob	NASA/JPL
Guerra, Lisa	NASA/GSFC
Hasan, Hashima	NASA Headquarters
Hertz, Paul	NASA Headquarters
Holt, Steve	NASA/GSFC
Jones, Vernon	NASA Headquarters
Kicza, Mary	NASA/GSFC
Lindstrom, Kurt	NASA Headquarters
Maizel, Roy	NASA Headquarters
Mellott, Mary	NASA Headquarters
Meyer, Michael	NASA Headquarters
Morrison, David	NASA/ARC
Netting, Ruth	NASA Headquarters
Newberry, Stan	NASA/JSC
Norris, Marian	NASA Headquarters

Pilcher, Carl	NASA Headquarters
Reber, Skip	NASA/GSFC
Riegler, Guenter	NASA Headquarters
Rummel, John	NASA Headquarters
Saunders, Steve	NASA/JPL
Slavin, Jim	NASA/GSFC
Smith, Howard	NASA Headquarters
Sorrels, Carrie	NASA Headquarters
Stringfellow, Guy	NASA Headquarters
Thronson, Harley	NASA Headquarters
Ulrich, Peter	NASA Headquarters
Withbroe, George	NASA Headquarters

Other Attendees:

Camorian, Guy	Dynamac
DiBiasi, Monty	L. DiBiasi Associates
Frankel, Paula	<i>[consultant]</i>
Strom, Keith	Lockheed Martin

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
Radisson Conference Center, Cape Canaveral, Florida
February 24-26, 1999

COMMITTEE STATEMENT AND RECOMMENDATIONS

March 8, 1999

Dr. Ed Weiler
Associate Administrator for Space Science
NASA Headquarters
Washington, DC 20546

Dear Ed:

The Space Science Advisory Committee (SScAC) met in Cocoa Beach, FL on February 24-26, 1998. We were pleased to be welcomed to the Space Coast by Roy Bridges, the Director of Kennedy Space Center. KSC plays an enormously important role in the Space Science Enterprise, and we were glad to hear from Mr. Bridges personally about the enthusiasm that KSC has for this role. The tour of KSC facilities following our meeting was especially appreciated. We were also very pleased that you were able to take time away from congressional hearings and family matters to be with us on Thursday.

The highlight of the meeting was hearing from you about the President's FY 2000 Budget and its out-year projections. The budget shows a significant rate of growth that is commensurate with both the excellent performance of the Enterprise in recent years and with the vigorous program planned for the future. We congratulate you for this, and also thank you for what we know must have been significant efforts on your part to maintain support for a robust and balanced program.

As you know, SScAC has previously expressed its concerns over the heavy workload on the personnel in the OSS Office at Headquarters, which has resulted in large part from the vigorous flight activity in the Space Science Enterprise. The SScAC was very pleased to hear from you that you have been successful in securing additional positions for the Office.

Guenter Riegler gave us an update on the Research Program. We congratulate him on his appointment as Acting Division Director, and also Code S on its wisdom in selecting him for this important job. In Guenter's presentation we were particularly impressed by the efficiency that has been brought to the R&A funding process by the "ROSS" NRA, and we compliment Code S and particularly Dave Bohlin for this innovation. ***We look forward to hearing at our next meeting about Code S's response to the past recommendations of the SScAC R&A Task Force chaired by David Black.***

Strategic Planning

A substantial fraction of our meeting dealt with our subcommittees' work in support of the next Space Science Strategic Plan. Our meeting was preceded by meetings of all four subcommittees. These meetings focussed on strategic planning, and there were several joint sessions in which two subcommittees met together to discuss topics of mutual scientific interest. These bilateral meetings were very successful, and I think they were a natural step in the evolution toward increasingly interdisciplinary research in space science. We will continue to have bilateral subcommittee meetings in the future.

It was clear in the subcommittee discussions that the "convergence retreat" in November will be a crucial event in the generation of the next Code S Strategic Plan. We are making good progress toward that event. ***It will be important that all the subcommittees clearly understand what is needed in preparation for the convergence retreat, and we stress the importance of clear guidance from Code S in this regard.***

Space Operations Management Office (SOMO)

One of the most important issues that we dealt with at our meeting was the Space Operations Management Office. We all benefited from the SOMO briefing by Stan Newberry, and very much appreciated his responsiveness in addressing our lengthy series of questions. Such direct communication between NASA/SOMO and the external user community will clearly be very useful to both parties for the foreseeable future. We also recognize that change is never easy, and that at least some of the discomfort that we have had with SOMO/CSOC may be a reaction to declining operations budgets. The SScAC supports NASA's move toward more efficient operations. In this regard, we note that SOMO's decade plan implicitly assumes that very substantial budget reductions will be offset by cost savings. We are concerned that this may be a very optimistic vision of SOMO's ability to perform its vital functions at a greatly reduced cost.

Safety of NASA space assets must be SOMO's number one priority, and we are concerned that some aspects of the SOMO approach could jeopardize safety. From the material presented to us, it also appears that there is an important lack of advice from external users in the space science community. ***The SScAC therefore recommends that the following two levels of user input be incorporated formally, on an ongoing basis, into NASA's mission operations management structure:***

1. ***A standing external oversight committee should be established to advise the Space Operations Council on SOMO/CSOC performance.*** Because the declining budget for mission operations engenders concerns about increased risk to NASA missions, a major responsibility of this committee should be ongoing oversight of mission safety with the goal of protecting valuable assets. This committee should be independent and composed of experts in space science, technical, and management areas.
1. ***A users group should be formed that communicates to both the SOMO head and the Space Operations Board of Directors***, to provide direct feedback from the end-user, as well as a

useful information channel from SOMO back to user community. This group should provide a mechanism for reviewing performance metrics, bringing user concerns to the attention of Agency managers, and similar advisory functions. Because there are already channels for such advice within NASA, such a users committee should consist primarily of scientists external to NASA.

When an Enterprise is the exclusive user of a service, it is most efficient for it to retain end-to-end responsibility. For example, ***the Space Science Enterprise is virtually the sole customer of the Deep Space Network (in the sense of using more than 95% of its services), and therefore in our view should have management responsibility for it.***

We endorse Stan Newberry's statement that SOMO's effectiveness would be ensured by providing customer freedom of choice, subject to considerations about the effective utilization of Agency infrastructure. Therefore ***it is essential that mission managers be empowered to make choices, based on tradeoffs between life-cycle costs and productivity, about utilization of SOMO or alternative services.*** We are not yet persuaded that SOMO's structure is optimal to encourage this.

We realize that the structure of SOMO is an Agency-wide issue, not just an OSS issue, and we hope that you will also bring our recommendations to the attention of other senior NASA managers.

Astrobiology

Harley Thronson brought us up to date on some of the most recent developments in the astrobiology program. As you know, the SScAC has been highly supportive of the NASA Astrobiology Institute (NAI), in part because the NAI represents an exciting experiment with the concept of a virtual institute. The committee is therefore naturally concerned by any movement away from the virtual nature of the NAI towards a brick and mortar concept for the Institute.

We heard for the first time at our meeting of plans for the construction of the Carl Sagan Astrobiology Laboratory at NASA Ames. We need to understand the plans for this Laboratory in greater detail before we can evaluate their consistency with the virtual nature of the NAI, as well as other potential implications for the NAI and the astrobiology program in general. ***We therefore request that we receive a briefing at our next meeting on the current plans for the NAI and the astrobiology program,*** with particular emphasis on the plans for this laboratory.

Ultra-Long Duration Balloons

Two SScAC subcommittees, the OS and the SEUS, were given briefings on the potential of ultra long-duration balloons (ULDB) as a launch system for space science missions. Both subcommittees were impressed by the potential inherent in this emerging capability, specifically the possibility of conducting space-quality missions on a low-cost, reusable launch system (a ULDB). In view of the cross-theme, indeed cross-Enterprise, potential of ULDBs, the SScAC encourages Code S to advocate ULDB as a candidate for Cross-Cutting Technology funds in the

Agency. The SScAC also recommends inclusion of balloon payloads in the upcoming SMEX AO.

That summarizes the results of our meeting. Please don't hesitate to contact me if you would like any clarification or further detail on any of the points I've raised above.

Best wishes,

Steve Squyres
Chair, SScAC

cc: SScAC
B. Parkinson
L. Garver
J. Rosendhal

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
Radisson Conference Center, Cape Canaveral, Florida
February 24-26, 1999

LIST OF PRESENTATION MATERIAL¹

- 1) Space Science Enterprise Strategic Management Status [Allen]
- 2) Solar System Exploration Subcommittee Report on Progress in Strategic Planning [Chyba]
- 3) SECAS Meeting Objectives/Output [Christensen]
- 4) OS Strategic Planning [Black]
- 5) Structure and Evolution of the Universe Subcommittee [Margon]
- 6) Task Force on Technology Readiness [Hastings]
- 7) Research Program Report [Riegler]
- 8) Space Operations Management Office (SOMO) [Newberry]
- 9) Space Science Enterprise [Weiler]
- 10) Mars Airplane Science Potential
- 11) ASO Theme Update
- 12) Planetary Protection Task Force Status [Rommel]

Other documents distributed at the meeting:

- 1) Astrobiology Roadmap
- 2) Astrobiology Institute brochure
- 3) SES Vacancy Announcement for Science Program Director
- 4) Headquarters Recruiting Bulletin for Space Science Program Manager
- 5) Solar Probe: First Mission to the Nearest Star

¹ Presentation and other material distributed at the meeting is on file at NASA Headquarters, Code S, Washington, DC 20546